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Transforming an Engineering Campus in Solar Energy Campus with Detailed Energy Audit

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Abstract: ***Energy is the first need for the economic development of any country. By reducing the cost and increasing the efficiency, of the energy we can achieve energy conservation, management and audit. And by using the renewable energy we gives no co2 and gases harmful impacts on environment. Renewable energy sources gives us a neat and clean energy with no harmful impacts. In this paper we shows the detailed audit of load of our scampus, collect the amount of electricity bill and backup protection amount like generator sets. Then analysis the cost of installing solar plant in the campus. Our main motive is to reduce in cost by using the solar plant and made a healthy environment.***

Keywords: Energy Audit, Solar energy audit, Data Collection, Payback period

1. Introduction

India is a developing country . Its per capita energy consumption is very low. We need to and have to use more and more energy to increase the pace of development. We need to increase the manufacturing of good in quality and volume. By using renewable energy we made the the quality of the energy. And the renewable energy also has the future scopes as we know the depletion of the non renewable sources and these type of sources made the environment pollute also. A huge amount of power generation in India is carried out by conventional energy sources, coal and fossil fuels being the primary ones, which contribute heavily to greenhouse gas emission and global warming. Electricity generation from renewable sources is increasingly recognized to play an important role for the achievement of a variety of primary and secondary energy policy goals, such as improved diversity and security of energy supply, reduction of local pollutant and global greenhouse gas emissions, regional and rural development, and exploitation of opportunities for fostering social cohesion, value addition and employment generation at the local and regional level. This focuses the solution of the energy crisis is done by using the renewable energy resources, such as biomass, solar, wind, geothermal and ocean tidal energy. The renewable energy scenario of any country is gives the future developments keeping in view the consumption, production and supply of power[1]. According to the national energy policy energy is the key towards raising the standard of living of citizens of any country. The correlation between the per capita electricity consumption and human development index (HDI) shows it clearly that energy gives the standard in living. Accordingly to the energy policies in india shows that our aim to raise the per capita consumption even while the main focus on development of country. With nearly 304 million Indians without access to electricity and about 500 million people still dependent on solid biomass for cooking. India strive to achieve in its income a double digit growth in its national income by making clean energy available to all its citizen. The aim of the national energy policy to chart the way forward to the major announcement of the government in energy domain. The world is moving on from the dependence on fossil fuels coil, oil and gases. An 88% of total share of fossil fuels is the primary source on energy till the year 2015 it falls 86% in the year 2015. The share of oil is fallen from 36% to 33% while the share of natural gas increase from 23% to 24% and the renewable energy has gone up from 12.5% to 14% in the period of 2005 to 2015[1]. Energy conservation involves the use of Technology that requires less energy to perform the same function. When a Compact Fluorescent light bulb is used instead of a Incandescent bulb is use less amount of energy compare to Incandescent light bulb is an example of energy efficiency. By replacing an Incandescent light bulb to a Compact Fluorescent is an example of Energy Conservation. Driving the same amount with a higher mileage vehicle is an example of Energy Efficiency[1]. Many times different-different acts started by government the main purpose of these acts is to promote the production of energy which is renewable energy. In these acts mainly focused on the use of renewable energy sources according to the climate and environment. Economic consideration also keep in mind to reduce our dependency on fossil fuels and other non renewable sources. We have to ensure the security of supply and reduce co2 emission and other greenhouse gases effects. This act also ensure the fulfillment of national and international objectives on increasing and proportion of energy produced through the use of renewable energy sources.[1]

2. Theoretical Background

Campus has been established by Pawan Ganga Educational Society, with a pivotal aim to take quality education to the door steps of rural and urban masses of the country. GITAM (Ganga institute of technology and management) is an institute duly approved by AICTE and Affiliated to Maharshi Dayanand University, Rohtak, Haryana. It has four blocks GITAM (Ganga institute of technology and management), GIE (Ganga institute of education), GIS (Ganga international school), GIATP (Ganga institute of architecture and town planning) GITAM has been treading the path of rapid development as per a neatly charted action plan since its inception in 2008.

2.1 Energy Audit

An energy audit is an inspection, survey, and analysis of energy flow in a building process or system with the objective of understanding the energy dynamics of the system under study. An energy audit is conducted to reduce the amount of input energy without effecting the system. An energy audit will be held in any industry building and at home also. We calculate the estimate energy used in one year billing history and other sources which are used in the building. And also calculate the renewable sources in the building if the renewable sources not takes place in the building we have to establish the renewable energy sources so that we save more and more energy. And the purpose of audit will be successful[8].
The Energy Audit is classified into the following two types.
i) Preliminary Audit
ii) Detailed Audit

In preliminary energy audit we take a glance on where we are using energy and where we can save energy with improvement the efficiency of devices . Also save energy from those areas where no need of it or less need by saving from those portions we can save energy.

In detailed energy audit we study about the area in detail. By collecting all the data where we uses energy (it includes all type of energy). Also collect total load and energy consumed by every equipment so we take a detail idea that in a specific area we invest what amount of energy. And by collecting these data we analysis all the load and amount spend on a particular area. After the collection of energy consumption we takes our methodology through which we can save the amount of energy. By replacing old equipments with new energy efficient equipments and saving of energy by using renewable energy sources for backup protection which is environmental friendly campare to desiel generator or other non renewable sources.

2.2 Energy Performance of Buildings

In the past decades air, soil and water pollution is increasing rapidly and many efforts are made worldwide so as to avoid the destruction of the environment. When observing that the worlds total final energy consumption during the last 35 years has more than doubled, according to IEA (2010) Key World Energy Statistics, with approximately 36% accounted to the building sector and that buildings are responsible for approximately 10-14% of the total CO_2 emissions in 2008 before allocating emissions from electricity and heat generation and approximately 33-44% after allocating emissions from energy production (IEA,2010) it is easy to conclude that measures should be taken if the situation is to be reversed. Given that the lifetime of buildings is rather long, between 50 and more than 100 years, and that the number of existing buildings with low energy performance is very high, the potential for improving their energy efficiency is rather large. The buildings that are over 30 years old are 70% of the building stock while approximately 35% are more than 50 years old, a fact that explains the emphasis that is given on the energy performance improvement of the existing buildings.In order that decisions can be made, there are various factors to be taken into account, some of them positively influencing decision-making and some of them with negative influences.[2]

2.3 Benefits of Improving the Energy Efficiency in Buildings

In order for the renovations, improvements and measures to be implemented the benefits of these interventions have to be evaluated and assessed. There are numerous benefits such investments could bring despite the fact that the most commonly used is the economic evaluation and sometimes the environmental impact of the interventions. The economic benefits are basically used for deciding whether an investment is feasible, profitable and if the present and future economic benefits are adequate for implementing such an investment. The other accompanying benefits are not taken into account in most cases, since the energy efficiency investments are considered and evaluated from a purely business economic perspective.

Economic Benefits: In order, though, to measure the economic benefits of an investment various parameters that have to been taken into account that could lead to different conclusions. For a more in depth analysis, the age of the building studied or the energy related costs should be taken into account. By calculating the age and equipments efficiency we can save cost by replacing them energy efficient devices.

Environmental Benefits: As already mentioned the building stock has a significant impact on the environmental pollution and consequently, interventions in order to improve their environmental performance, should be measured and evaluated. The most thoroughly studied pollutant in the terms of emissions reduction caused by energy efficiency measures taken is CO_2 .[2]

3. Methodology and Data Collection

Energy audit is the key which gives a systematic approach for energy management. Energy management is not by chance/incident/accident. It is a mission with a target. It can not be done single handedly or by sitting on a table. It needs coordinated effort With team of energy conscious people with a milestone to be established energy management. Strategy needs to be establishment based on the target of energy conservation or energy auditing.

In Methodology we first have to collect the data through the preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, introduction and measurements to determine or evaluation of the equipments. To implement or draw a new idea we first have to know about the current situation of the campus. The major portion of electricity consuming devices, annual electricity bill consumption and diesel consumption of the campus we have to know so that we estimate the solar panels in the building. Here we know step by step used methodology:-

a) First we take a overview of the campus.
b) Then we analysis the total electrical load of all campus.
c) The next step is to calculate the load of all equipments and all sources which consume electrical energy.

d) In next step collect the data of energy consumption by backup devices like generator sets and inverter etc.
e) In next step collect the electricity bill of a recent year.
f) Now we calculate the total amount or cost spend on the electricity bill and generator set bills.
g) Now we came on our main motive which is the cost installing an solar plant.
h) Suggestion to replace the low efficiency devices with new energy efficient devices.
i) Calculate the total payback period by solar and with no harmful impact on environment.

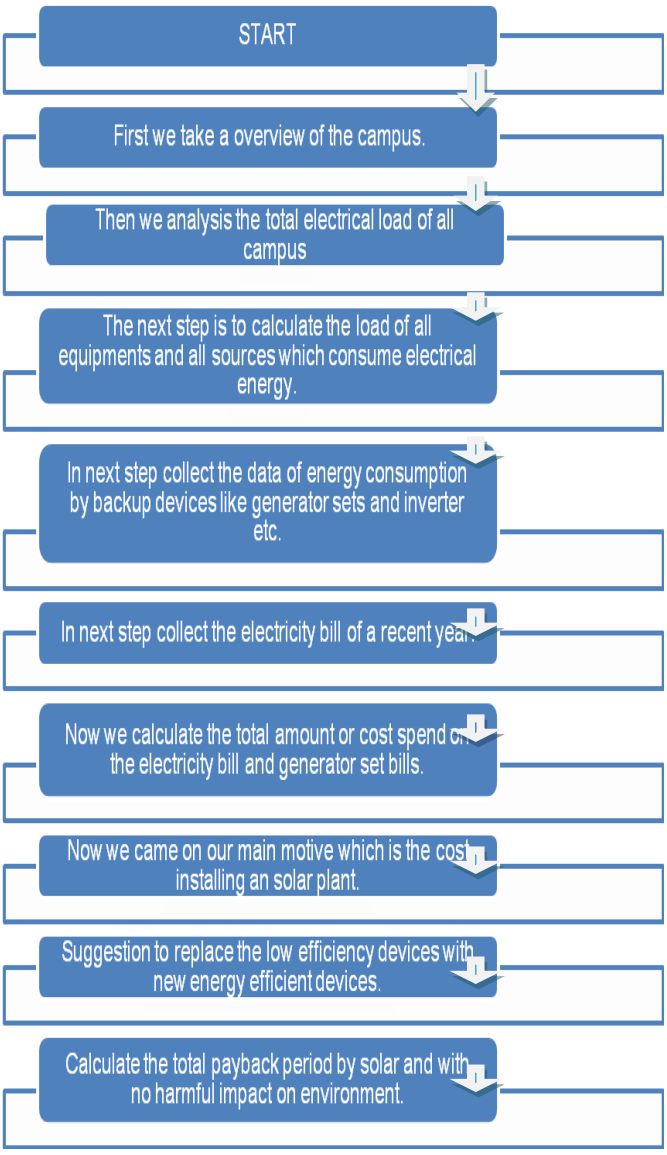

Figure: Flow chart of Methodology used

4. Consumption of Energy in Campus

The total energy consumption in the campus including all sections of campus:-

The Campus has four blocks our engineering campus Ganga institute of technology and management, Ganga institute of Education, Ganga international school and Ganga institute of Architecture and town planning. And the energy consumption by all labs equipments.

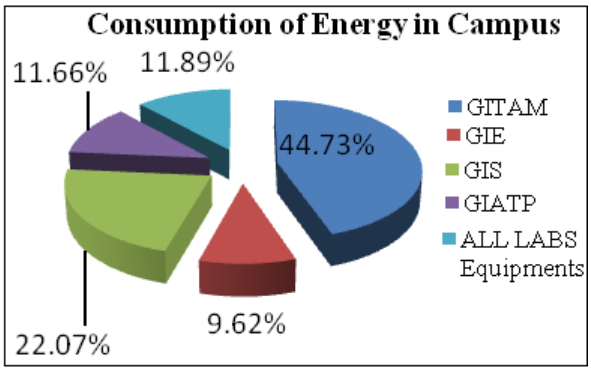

Figure: Energy Consumption in Campus

Units consumed on electricity bill in year 2017-2018

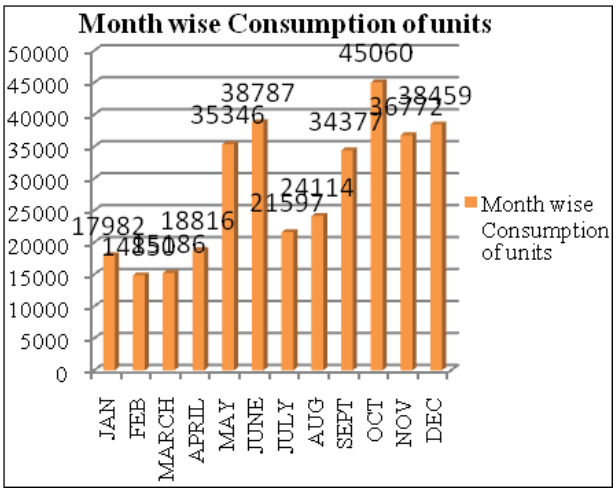

Figure: Units consumed on electricity bill in 2017-2018

The above graph shows the consumption of units in every month of year 2017-2018.

Amount Consumed through Electricity Bill in 2017-2018.
The below graph shows the amount spend on electricity bill in month wise in year 2017-2018

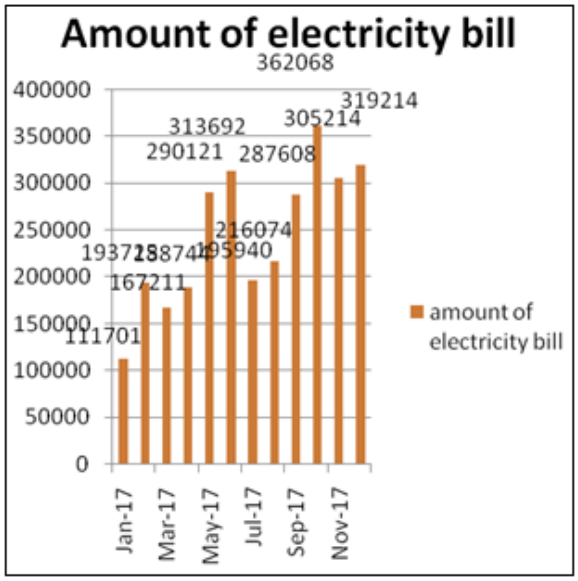

Figure: Month wise Amount of electricity Bill 2017-2018

Total Amount Spend on Energy in year 2017-2018

The below chart shows the total amount spend on energy through electricity bill and backup which is diesel generator set . Here are two generator sets uses for backup protection first one is 62KVA and the second is 140KVA diesel generator set.

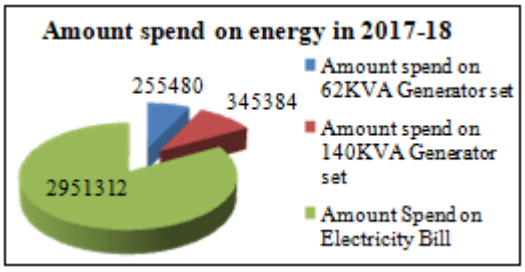

Figure: Amount Spend on Energy in 2017-2018

5. Saving or Payback Period by Solar Plant

The solar energy has many advantages over diesel generator set. It gives no harmful impact on environment like co2 and other gases impacts. We installed solar plant of 250kw in campus and it gives saving.

Total Amount Spend on energy in 2017:-3816912Rs/-
Total Amount Spend on Installing Solar Plant:-7369088Rs/-
Current Unit Rate paid to electricity board:- 8.00Rs/-
Payback period after installing solar plant:-

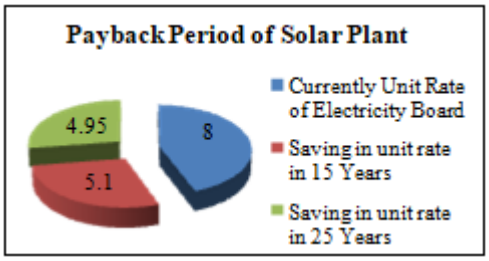

Figure: Payback period through reducing unit rate.

6. System Studies

According to the national energy policy energy is the key towards raising the standard of living of citizens of any country. The correlation between the per capita electricity consumption and human development index (HDI) shows it clearly that energy gives the standard in living. Accordingly to the energy policies in india shows that our aim to raise the per capita consumption even while the main focus on development of country. With nearly 304 million Indians without access to electricity and about 500 million people still dependent on solid biomass for cooking. India strive to achieve in its income a double digit growth in its national income by making clean energy available to all its citizen. The aim of the national energy policy to chart the way forward to the major announcement of the government in energy domain. The world is moving on from the dependence on fossil fuels coil, oil and gases. An 88% of total share of fossil fuels is the primary source on energy till the year 2015 it falls 86% in the year 2015. The share of oil is fallen from 36% to 33% while the share of natural gas increase from 23% to 24% and the renewable energy has gone up from 12.5% to 14% in the period of 2005 to 2015.[1]

7. Conclusion

The maximum capacity we can installed in our campus is 331.5 KWP but currently we advise as per consumption is only 225 KWP. So in future we can easily increase its capacity if our consumption is increased. This work can be extended further in installing 1 MW solar power plant in the campus yard. So we can produce our total required power and remaining power can be given to the local grid. So by using this way we can improve the energy efficiency and saving money and environment. And solar gives payback by reducing the amount in form of electricity bill and environment friendly.

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